SECTION 71

TANK LEVEL INDICATORS

71.1 REFERENCES

(71A) **VOLUME V** – *OWNER - FURNISHED EQUIPMENT*

71.2 INTRODUCTION

This Section contains the Contractor Design and Provide general requirements applicable to the tank level indicators/alarms and supplements requirements described in other Sections of the Technical Specification.

For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.

71.3 GENERAL

Overall gage accuracy shall be within plus or minus 1-percent (±1%) of full-scale reading. For all odd shaped tanks the gage scales should be individually calibrated using tank capacity curves.

Each gage shall be provided with a nameplate that clearly indicates the tank being served as specified in Section 24 of the Technical Specification.

Tanks are specified in Section 78 of the Technical Specification.

Alarms, alarm set points, and alarm switches are described and specified herein and/or in Section 95 of the Technical Specification.

A book listing all tanks and voids sounding tables and capacity curves shall be provided as specified in Section 100 of the Technical Specification. The tables shall list depth versus volume in gallons. Depending on volume, depth shall be listed in inches, or feet and inches.

Maintenance and replacement of **all** level system components inside the tanks shall be possible without personnel entering the tank.

The tank high/low level alarms shall have built-in time delays to accommodate Vessel motions. The Propulsion System Integrator (PSI) Contractor will be responsible for this function.

All tank level indicators, unless indicated otherwise in the Technical Specification, shall interface with the PSI Contractor SCADA alarm system. Analog tank level sensors and level switches associated with the PSI Contractor SCADA alarm system will be Owner - Furnished Equipment (OFE) material.

The fuel oil tank level indicators and alarm system shall be an intrinsically safe type where required by Authoritative Agencies.

Where a local direct reading liquid level indicator is specified, unless specifically called out differently in the Technical Specification, a stainless steel GEMS SureSite®, or equal, indicator shall be provided. **See TABLE 71-1**.

Level switch controls for machinery and other equipment are described in the applicable Sections of the Technical Specification.

A sounding tube **shall not** be a substitute for a local level indicator.

71.4 TANK LEVEL INDICATORS AND ALARMS

Tank level indicating systems that are electrically operated and form part of the PSI Contractor's SCADA alarm system, will be delivered with OFE supplied transducers and equipment which the Contractor shall install. The Contractor shall design, provide and install all associated cabling, wireways, foundations, penetrations, valves, fittings and appurtenances to provide a complete and operable system. See Reference (71A).

The Contractor shall design, provide, and install an independent electrically operated tank level indicating (TLI) system that does not interface with the PSI Contractor's SCADA alarm system. The TLI system shall be comprised of a RED LION G310C000, or equal, ten (10) inch color touch-screen operator interface/tank level display, or equal, complete with a RED LION CSMSTRSE, or equal, modular control master, and a RED LION CSINI800, or equal, 4-20 mA eight (8) channel input module mounted in the EOS as approved by the WSF Representative; two (2) each RED LION G308C000, or equal, eight (8) inch color touch-screen operator interface/tank level displays mounted at the fuel transfer manifold and the Lower Vehicle Deck fueling station as approved by the WSF Representative; and four (4) each RED LION PAXP0000, or equal, seven-segment LED digital display panel meters located at the Oily Bilge and Used Oil Holding Tanks in each Engine Room as approved by the WSF Representative.

For the Port and Starboard Fuel Storage Tanks, the Fuel Oil Day Tank, the Fuel Oil Overflow Tank, the No. 1 and No 2 Oily Bilge Tanks, and the No 1 and No 2 Used Oil Tanks provide and install NOSHOK 615/616 Series, or equal, 4-20 mA pressure transducers at the outside of the tank, isolated from the tank by a one (1) inch ball valve flange-mounted to the tank, to read as close to the bottom of the tank as possible.

In the air bubbler lines to the Port and Starboard Sewage Holding Tanks provide and install NOSHOK 615/616 Series, or equal, 4-20 mA pressure transducers located near the tank

tops. See the *MATERIALS* Subsection in Section 74 of the Technical Specification for a description of the bubbler gage piping material requirements.

Provide power to the system from the 24 Vdc battery distribution panel in the EOS. Consult RED LION CONTROLS, or equal, for proper installation and requirements of the system. The Contractor shall provide and install all associated cabling, wireways, foundations, penetrations, valves, fittings and appurtenances to provide a complete and operable system. See Reference (71A). See Section 96 of the Technical Specification for a description of the 24 Vdc power distribution system.

Provide a RED LION CBLPROC0, or equal, programming cable, or equal and RED LION field technical service to create the tank mimic screens on the displays, configure the digital panel meters and transducers, and otherwise commission the TLI system. The artwork on the display screens as well as the number of screens shall be as approved by the WSF Representative.

71.4.1 Tank Level Indication and Alarm Systems

The Contractor shall design and provide the following tank level indication and alarm systems utilizing OFE transducers and equipment where indicated:

71.4.1.1 Fuel Oil Storage, Day and Overflow Tanks

An electrically operated tank level indicating system shall be installed to serve each fuel oil storage tank, day tank and overflow tank. Each storage tank shall have a high level audible/visual alarm set at 95-percent (95%) of tank capacity. In addition to the high level alarm, the fuel oil service tanks shall have a low level audible/visual alarm set at 25-percent (25%) of tank capacity. The designated fuel oil overflow tank shall have a high level audible/visual alarm set at a tank capacity that will provide the Vessel's engineer with ample warning of an overflow condition so that fueling operations can be secured without a spill at the Vessel's design fueling rate. The components of this system are provided as OFE by the PSI SCADA alarm system contractor.

The Emergency Diesel Generator FO tank shall be equipped with a local direct reading liquid level indicator. A regulatory approved "bulls-eye" sight glass shall be provided in the tank overflow piping to the day tank that is easily visible by the Engineer from the fuel oil transfer station serving the tank.

Tank level indicators shall be located at the EOS Control Console, transfer manifold, and fueling station in accordance with the requirements of the *TANK LEVEL INDICATORS AND ALARMS* Subsection in this Section of the Technical

Specification. Individual tank high level audible/visual alarms shall be located at the EOS Control Console with summary alarms located at the transfer manifold(s) and at the fueling station. These alarms are part of the PSI Contractor SCADA alarm system and their components are OFE.

The overflow piping header(s) serving all fuel oil storage and day tanks shall be equipped with a device(s) to activate an audible/visual alarm(s) when a tank overflow condition occurs. Tank overflow audible/visual alarm(s) shall be located at the EOS Control Console with a summary alarm located at the transfer manifold(s) and at each fueling station. These alarms are part of the PSI Contractor SCADA alarm system and their components are OFE.

See **TABLE 71-1** requirements below.

71.4.1.2 Lubricating Oil Storage Tanks

The Propulsion Engine, Ship's Service Diesel Generator and Reduction Gear lube oil storage tanks, and all other lube oil storage tanks shall be equipped with tank level indicators.

See **TABLE 71-1** requirements below.

71.4.1.3 Propulsion Engine Sumps

The Propulsion Engine lube oil sumps shall have audible/visual low level alarms located at the EOS Control Console.

Lube oil sumps integral with the engine shall have provisions for determining the lube oil level in accordance with the manufacturer's requirements.

Lube oil sumps not integral with the engine shall be equipped with tank level indicators located at the EOS Control Console.

See **TABLE 71-1** requirements below.

71.4.1.4 Jacket Water Holding Tanks

The Contractor shall design and provide a sounding tube only for the tank.

See **TABLE 71-1** requirements below.

71.4.1.5 Main Engine SCAC Expansion Tank

See **TABLE 71-1** requirements below.

71.4.1.6 Jacket Water Expansion Tanks

The Jacket Water Expansion Tanks for all diesel engines and the radiator cooled Emergency Diesel Generator Set shall be designed and provided with local direct reading sight glasses.

All high level, low level sensors, temperature alarms, set points, etc., will be specified in the Section which details the equipment, or can be found in Section 99 of the Technical Specification.

See **TABLE 71-1** requirements below.

71.4.1.7 Oily Bilge Water and Used Oil Tanks

The Oily Bilge Water and Used Oil Tanks shall be equipped with tank level indicators and alarms. Each holding tank shall have a level indicator and a high level audible/visual alarm set at 95-percent (95%) of tank capacity located at the EOS Control Console. The alarms sensors for these tanks are part of the PSI Contractor's SCADA alarm system and provided as OFE. See the *TANK LEVEL INDICATORS AND ALARMS* Subsection in this Section of the Technical Specification for a description of the Contractor's TLI system.

See **TABLE 71-1** requirements below.

71.4.1.8 Sewage Holding and Sewage Lift and Transfer Tanks

The Sewage Holding Tanks shall have variable level pressure sensor air bubbler systems in the tanks installed in standpipes , sensed by pressure transducers reading the standpipe air pressure, with remote level indicators located at the EOS Control Console. See the *Level Sensing* Subsection in Section 7 of Reference (71A) and also the *TANK LEVEL INDICATORS AND ALARMS* Subsection in this Section of the Technical Specification for Contractor's TLI installation requirements.

Each tank shall have audible/visual high level alarms at the EOS Control Console set to indicate tank level at 90-percent (90%).

Sewage Lift and Transfer Tanks shall have high level alarms which shall alarm at the EOS Control Console.

See **TABLE 71-1** requirements below.

71.4.1.9 Potable Water Storage and Freshwater Backflush Tanks

The Potable Water Storage and Freshwater Backflush Tanks shall be equipped with local direct reading liquid level indicators and alarms. Individual high level audible/visual alarms and level indicators shall be located at the EOS Control Console with summary high level alarms (Potable Water Storage Tanks only) located at the Lower Vehicle Deck fill station(s).

See **TABLE 71-1** requirements below.

71.4.1.10 Hot Water Heating Head Tank

The Hot Water Heating Head Tank is part of a waste heat recovery system.

See **TABLE 71-1** requirements below.

71.4.1.11 Freshwater Cooling Head Tank

See **TABLE 71-1** requirements below.

71.4.1.12 CPP Oil Tanks

See **TABLE 71-1** requirements below.

71.4.1.12.1 CPP Hydraulic Oil Reservoir Tanks

The CPP Hydraulic Oil Reservoir Tanks shall be equipped with local direct reading liquid level indicators and low level audible/visual alarms located at the EOS Control Console.

71.4.1.12.2 CPP Drain Tank

See **TABLE 71-1** requirements below.

71.4.1.12.3 CPP Storage Tank

See **TABLE 71-1** requirements below.

71.4.1.12.4 CPP Hub Oil Tank

See **TABLE 71-1** requirements below.

71.4.1.13 Stern Tube Oil Head Tanks

See **TABLE 71-1** requirements below.

71.4.1.14 Stern Tube Inboard Seal Oil Tank

See **TABLE 71-1** requirements below.

71.4.1.15 Purifier Sludge Tank

The Purifier Sludge Tank (overflow chamber) shall be equipped with a level indicator and a high level audible/visual alarm located at the EOS Control Console. The separation chamber shall have a sounding tube.

See **TABLE 71-1** requirements below.

71.4.1.16 Clean Fuel Oil (Leak Off) Drain Tank

Clean Fuel Oil (Leak Off) Drain Tank(s), if required for the engine selected, shall have a local level indicator and audible/visual high level alarm located at the EOS Control Console.

See **TABLE 71-1** requirements below:

TABLE 71-1

TANK LEVEL SENSORS

TANK(S)	LEVEL INDICATOR TYPE				REMARKS
	OFE Transducer	SureSite® Or Equal	Gage Glass	Sounding Tube	
Fuel Oil Storage	✓			✓	Contractor shall provide and install additional transducer for an independent TLI system
Fuel Oil Day	✓			✓	Contractor shall provide and install additional transducer for an independent TLI system
Emergency Diesel Generator Fuel Oil	✓	✓			Includes a “bulls-eye” sight glass installed in the tank overflow piping
Fuel Oil Overflow	✓			✓	Contractor shall provide and install additional transducer for an independent TLI system
Lubricating Oil Storage		✓			
Engine Sump	✓				
Jacket Water Holding				✓	

TABLE 71-1, cont'd

TANK LEVEL SENSORS

TANK(S)	LEVEL INDICATOR TYPE				REMARKS
	OFE Transducer	SureSite® Or Equal	Gage Glass	Sounding Tube	
Main Engine SCAC Expansion Tank	✓		✓		
Jacket Water Expansion	✓		✓		
Oily Bilge Water	✓			✓	Contractor shall provide and install additional transducer for an independent TLI system
Used Oil	✓			✓	Contractor shall provide and install additional transducer for an independent TLI system
Sewage Holding	✓				Contractor shall provide and install additional transducer for an independent TLI system
Sewage Lift and Transfer Stations	✓				High level alarm
Potable Water Storage	✓	✓			
FW Back-flushing Water Storage	✓	✓			
Water Heating Head	✓	✓			

TABLE 71-1, cont'd

TANK LEVEL SENSORS

TANK(S)	LEVEL INDICATOR TYPE				REMARKS
	OFE Transducer	SureSite® Or Equal	Gage Glass	Sounding Tube	
FW Cooling Head	✓	✓			
CPP Hydraulic Oil Reservoir	✓		✓		Two (2) tanks
CPP Drain	✓			✓	Two (2) tanks. Sounding tube with dip stick
CPP Storage			✓		Two (2) tanks
CPP Hub Oil	✓	✓			Two (2) tanks
Stern Tube Oil Head	✓	✓			Two (2) tanks; high & low level alarms
Stern Tube Inboard Seal Oil	✓		✓		Two (2) tanks
Purifier Sludge			✓		Alarm transducer to be provided with tank
Clean Fuel Oil (Leak Off) Drain	**	**	**	**	** Provide if and as required to suit Contractor's design

71.5 BILGE LEVEL ALARMS

All machinery spaces shall have high bilge level alarms with remote indication at the EOS Control Console. The bilge high level alarm system shall be arranged to detect an excessive rise of water in the bilges or bilge wells. The bilge level alarm sensors are part of the PSI Contractor's SCADA alarm system and provided as OFE. See Reference (71A).

71.6 SPARE PARTS AND INSTRUCTION MANUALS

Provide a list of recommended spare parts and special tools, for those items which are Contractor furnished, together with parts lists and instruction manuals necessary to maintain and service provided equipment and accessories in accordance with the requirements of Sections 86 and 100 of the Technical Specification.

71.7 TESTS, TRIALS AND INSPECTIONS

All tests and/or shall be in accordance with this Section and Section 101 of the Technical Specification.

Inspections shall be performed as defined in this Section and in Sections 1 and 2 of the Technical Specification.

71.8 PHASE II TECHNICAL PROPOSAL REQUIREMENTS

The following deliverables, in addition to others required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be submitted during the Phase II Technical Proposal preparation stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Tank Level Indicator/Alarm System Report

B. Tank Level Indicators and Alarms List

The ***Tank Level Indicator / Alarms System Report*** shall fully describe the indicator/alarm system to be installed. The report shall include appropriate vendor supplied information relating characteristics of the system components.

The ***Tank Level Indicators and Alarms List*** may be included in the related system report in lieu of providing it as a separate deliverable.

See Section 100 the Technical Specification for additional requirements regarding technical documentation.

71.9 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS

The following deliverable, in addition to others required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be submitted during the Phase III Detail

Design stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Tank Level Indicators and Alarms List

The final ***Tank Level Indicators and Alarms List*** shall include alarm setting and location for each alarm.

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

(END OF SECTION)